NELLIS/QUAIL SPRING G-E-M RESOURCES AREA

(GRA NO. NV-33)

TECHNICAL REPORT

(WSAs NV 050-0411, 050-04R-15A, B, and C)

Contract YA-553-RFP2-1054

Prepared By

Great Basin GEM Joint Venture
251 Ralston Street
Reno, Nevada 89503

For

Bureau of Land Management
Denver Service Center
Building 50, Mailroom
Denver Federal Center
Denver, Colorado 80225

Final Report

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EXECUTIVE SUMMARY

The Nellis/Quail Spring Geology-Energy-Minerals (GEM) Resource Area (GRA) includes the following Wilderness Study Areas (WSAs): NV 050-0411 and NV 050-04R-15A, B & C. The Nellis/Quail Spring GRA is located in Clark County, Nevada just north of Las Vegas at the south end of the Las Vegas Range. The included WSAs border the south edge of the Desert National Wildlife Range.

Geologically the GRA consists predominantly of carbonate Paleozoic rocks (300 to 600 million years old) in the northeast quadrant and alluvial fans elsewhere. The WSAs are underlain exclusively by alluvial fans derived from the mountains to the north.

The only known metallic mineral resources known in the GRA are found in the Gass Peak district in the northeast part of the study area but they are outside the WSAs. Here a limited amount of zinc was produced along with lesser amounts of lead, silver and gold. No metallic production came from within the WSAs. A very limited production of marble came from the bedrock units outside the WSAs also. Zinc and silver are the only strategic and critical minerals which have been produced from within the GRA.

There are no patented claims in the GRA. Unpatented claims are found in the Gass Peak mining district and in the alluvium in the western part of the GRA. There are seven unpatented placer claims in WSA NV 050-0411, the other WSAs contain no claims.

All of the land within the WSAs have been leased for oil and gas. There are no geothermal leases in the GRA.

The WSAs are considered to have a low favorability for metallic mineral resources with a very low confidence level as the nature of the bedrock beneath the alluvium is unknown. All the areas in the WSAs have a moderate potential for sand and gravel with a moderate confidence level as they are composed entirely of sand and gravel. Uranium and thorium have a very low favorability with a very low confidence level. Oil and gas has a low favorability with a very low confidence level. Geothermal has a moderate favorability with a very low confidence level.

It is recommended these WSAs be further evaluated for their sand and gravel potential for the nearby construction market and that the placer claims staked by Vega Inc. be further evaluated.

I. INTRODUCTION

The Nellis/Quail Spring G-E-M Resources Area (GRA No. NV-33) covers approximately 100,000 acres (420 sq km) and includes the following Wilderness Study Areas (WSAs):

WSA Name	WSA Number
Quail Springs	NV 050-0411
Nellis	NV 050-04R-15A,B,C,

The GRA is located in Nevada within the Bureau of Land Management's (BLM) Esmeralda Resource Area, Las Vegas district. Figure 1 is an index map showing the location of the GRA. The area encompassed is near 36°23' north latitude, 115°15' west longitude and includes the following townships:

T 17 S, R 59-62 E
T 18 S, R 59-62 E
T 19 S, R 59-62 E

The areas of the WSAs are on the following U. S. Geological Survey topographic maps:

15-minute:

Corn Creek Springs	Gass Peak

7.5 minute:

Corn Creek Springs, NW	Corn Creek Springs
Tule Spring Park Valley	Gass Peak, SW

The nearest town is North Las Vegas which is located less than 10 miles south of the southern border of the GRA. Access to the area is via U. S. Highway 95 to the south and west, and Interstate 15 to the southeast. Access within the area is via Mormon Wells Road, Quail Spring Road, and a few scattered unimproved dirt roads and jeep trails.

Figure 2 outlines the boundaries of the GRA and the WSAs on a topographic base at a scale of 1:250,000.

Figure 3 is a geologic map of the GRA and vicinity, also at 1:250,000. At the end of the report, following the Land Classification Maps, is a geologic time scale showing the various geologic eras, periods and epochs by name as they are used in the text, with the corresponding age in years. This is so that the reader who is not familiar with geologic time subdivisions will have a comprehensive reference for the geochronology of events.

This GRA Report is one of fifty-five reports on the Geology-Energy-Minerals potential of Wilderness Study Areas in the Basin and Range Province, prepared for the Bureau of Land Management by the Great Basin GEM Joint Venture.

The principals of the Venture are Arthur Baker III, G. Martin Booth III, and Dennis P. Bryan. The study is principally a literature search supplemented by information provided by claim owners, other individuals with knowledge of some areas, and both specific and general experience of the authors. Brief field verification work was conducted on approximately 25 percent of the WSAs covered by the study.

None of the WSAs in this GRA were field checked.

One original copy of background data specifically applicable to this GEM Resource Area Report has been provided to the BLM as the GRA File. In the GRA File are items such as letters from or notes on telephone conversations with claim owners in the GRA or the WSA, plots of areas of Land Classification for Mineral Resources on maps at larger scale than those that accompany this report if such were made, original compilations of mining claim distribution, any copies of journal articles or other documents that were acquired during the research, and other notes as are deemed applicable by the authors.

As a part of the contract that resulted in this report, a background document was also written: Geological Environments of Energy and Mineral Resources. A copy of this document is included with the GRA File to this GRA report. There are some geological environments that are known to be favorable for certain kinds of mineral deposits, while other environments are known to be much less favorable. In many instances conclusions as to the favorability of areas for the accumulation of mineral resources, drawn in these GRA Reports, have been influenced by the geology of the areas, regardless of whether occurrences of valuable minerals are known to be present. This document is provided to give the reader some understanding of at least the most important aspects of geological environments that were in the minds of the authors when they wrote these reports.

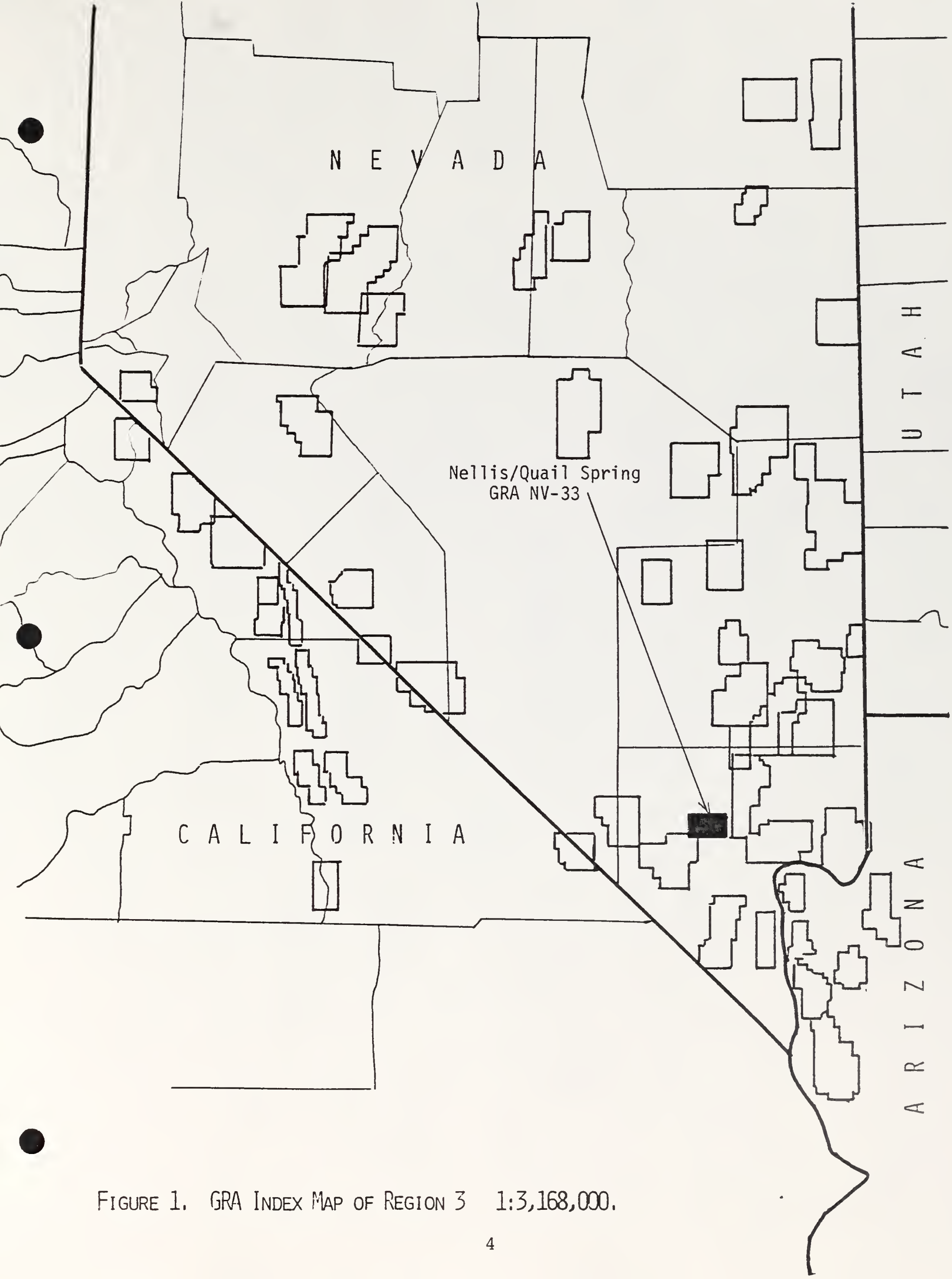
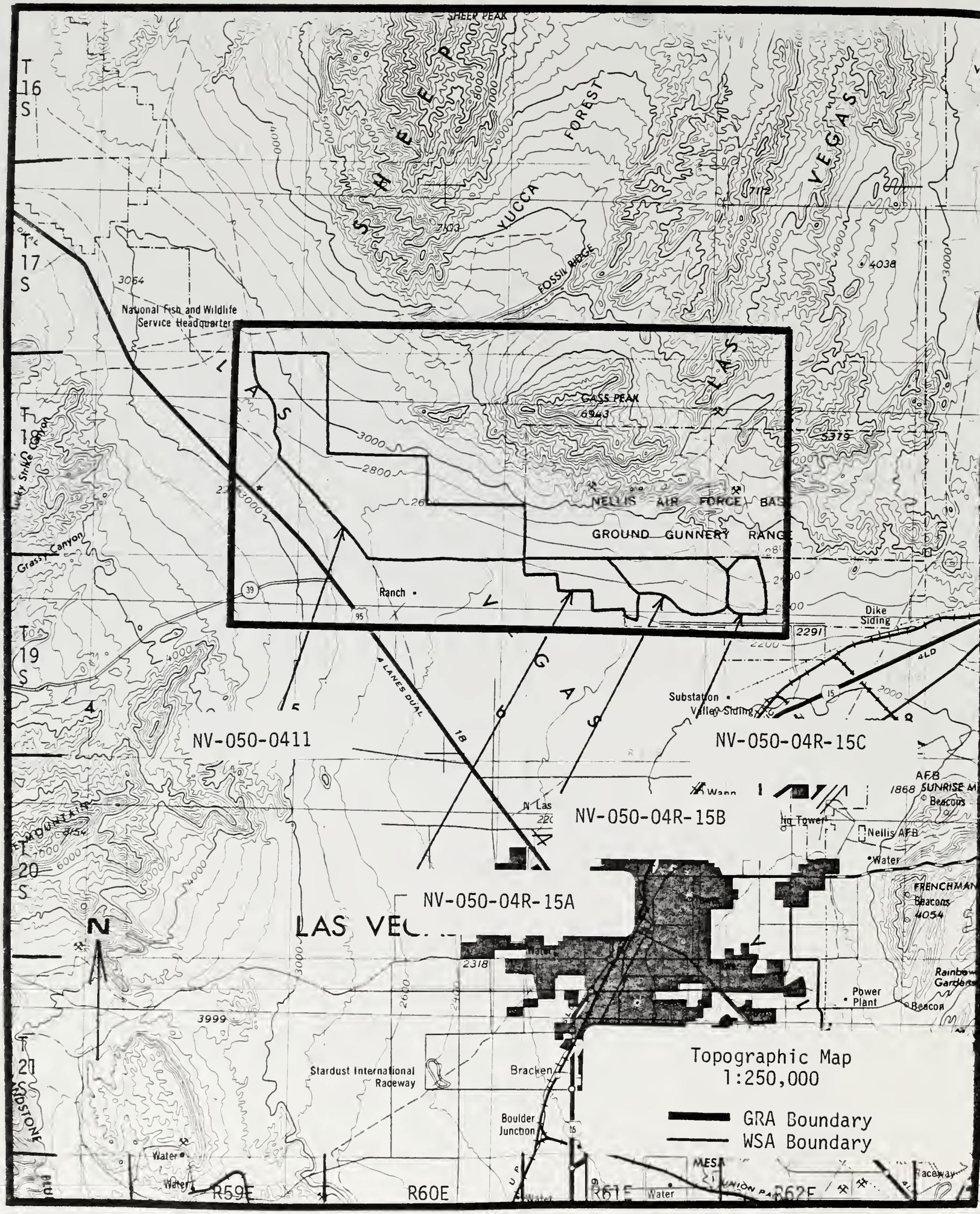
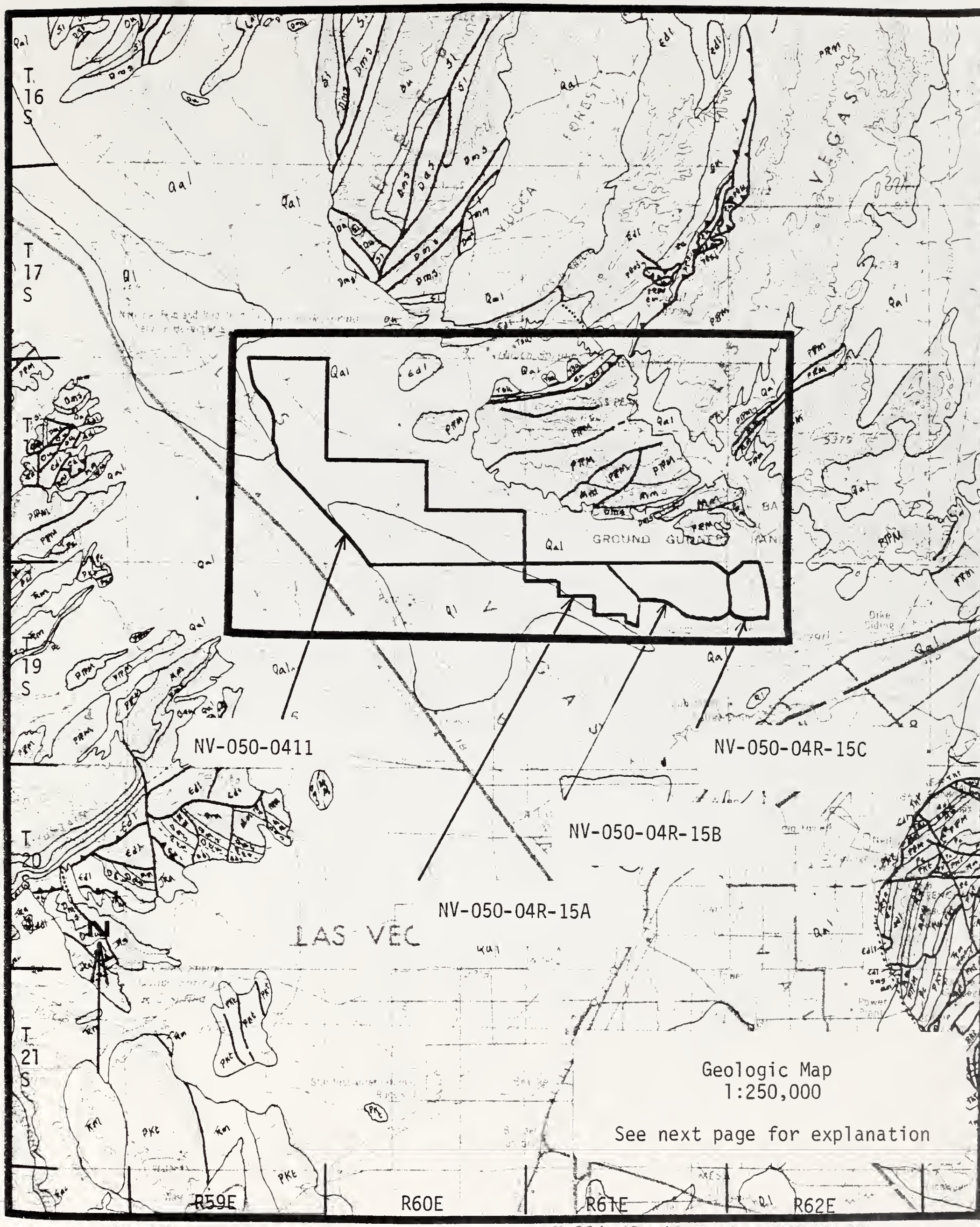


FIGURE 1. GRA INDEX MAP OF REGION 3 1:3,168,000.



Las Vegas Sheet

Nellis/Quail Spring GRA NV-33
Figure 2



Bohannon (1978)

Nellis/Quail Spring GRA NV-33

Figure 3

DESCRIPTION OF MAP UNITS

Qal	ALLUVIAL DEPOSITS (HOLOCENE AND PLEISTOCENE?)
Qp	PLAYA DEPOSITS (HOLOCENE AND PLEISTOCENE?)
Qc	CHEMEHUEVI FORMATION (PLEISTOCENE)
Ql	LAS VEGAS FORMATION (PLEISTOCENE)
Qm	CALICHE OF MORMON MESA (PLEISTOCENE)
Qrd	GRAVEL OF THE COLORADO AND VIRGIN RIVERS (LOWER PLEISTOCENE)
QTal	ALLUVIAL FAN DEPOSITS (QUATERNARY AND TERTIARY)
Tb	BASALT (PLIOCENE AND MIOCENE)
	MUDDY CREEK FORMATION (PLIOCENE? AND MIOCENE)
Tm	Claystone unit
Tmf	Fortification Basalt Member
Tpav	ASH-FLOW TUFF (MIOCENE)
Tp	ROCKS OF PAVITS SPRINGS (MIOCENE)
Thv	ROCKS OF THE HAMBLIN-CLEOPATRA VOLCANO (MIOCENE)
Thvi	INTRUSIVE ROCKS (MIOCENE)
Tmdv	MOUNT DAVIS VOLCANICS (MIOCENE)
	HORSE SPRING FORMATION (MIOCENE)
Ths	Sandstone and silver tuff
Thl	Rocks of Lovell Wash
Thb	Limestone of Bitter Ridge
Tht	Lower member
Tsu	UNDIFFERENTIATED SEDIMENTARY ROCKS (TERTIARY)
Kb	BASELINE SANDSTONE (UPPER AND LOWER CRETACEOUS)
Kwt	WILLOW TANK FORMATION (LOWER CRETACEOUS)
Ja	AZTEC SANDSTONE (JURASSIC)
₮mc	MOENAVE (UPPER TRIASSIC?) AND CHINLE (UPPER TRIASSIC) FORMATIONS
₮m	MOENKOPI FORMATION (MIDDLE? AND LOWER TRIASSIC)
Pkt	KAIBAB LIMESTONE AND TOROWEAP FORMATION (LOWER PERMIAN)
Pc	CLASTIC ROCKS (LOWER PERMIAN)
PPM	CALLVILLE LIMESTONE AND BIRD SPRING FORMATION (LOWER PERMIAN, PENNSYLVANIAN AND UPPER MISSISSIPPIAN)
Mm	MISSISSIPPIAN ROCKS
	DEVONIAN ROCKS
Dmp	Muddy Peak Limestone
Dms	Sultan Limestone
Sl	SILURIAN ROCKS
Ou	ORDOVICIAN ROCKS
OCu	UNDIFFERENTIATED ORDOVICIAN AND CAMBRIAN ROCKS
Cdl	CARBONATE ROCKS (UPPER AND MIDDLE CAMBRIAN)
Cu	UNDIFFERENTIATED CLASTIC ROCKS (MIDDLE AND LOWER CAMBRIAN)
C-Du	UNDIFFERENTIATED DEVONIAN THROUGH CAMBRIAN ROCKS
Pzu	UNDIFFERENTIATED PALEOZOIC ROCKS
pCsj	STIRLING QUARTZITE AND JOHNNIE FORMATION (PRECAMBRIAN)
pCum	ULTRAMAFIC ROCKS (PRECAMBRIAN)
pCgn	GNEISS AND SCHIST (PRECAMBRIAN)
pCrg	RAPAKIVI GRANITE (PRECAMBRIAN)

CONTACT

FAULT

THRUST FAULT

LOW-ANGLE FAULT

ANTICLINE

SYNCLINE

II. GEOLOGY

The Nellis/Quail Spring GRA lies within the Basin and Range Province in central Clark County about eight miles north of Las Vegas. The included WSAs in the GRA are adjacent to the Desert National Game Range to the north. The study area contains Gass Peak, the southernmost extension of the northeast-trending Las Vegas Range and a portion of Las Vegas Valley to the south and west of Gass Peak.

The study area contains an assemblage of Paleozoic clastic and carbonate rocks which have been unconformably overlain by carbonate beds of the early Tertiary Horse Springs Formation. Quaternary gravels and fanglomerates of the Las Vegas Formation are found in the Tule Springs area in Las Vegas Valley (see Figure 3).

The above mentioned formations have been displaced by thrust faulting, folding and reverse faulting related to the late Cretaceous Laramide Orogeny. Basin and Range faulting further offset the sedimentery sequences during the late Tertiary.

The WSAs within the GRA are underlain exclusively by alluvium; there are no bedrock outcrops in the WSAs.

The following geologic description is taken from Longwell and others (1965).

1. PHYSIOGRAPHY

The Nellis/Quail Spring GRA lies within the Basin and Range Province in central Clark County about eight miles north of Las Vegas. The study area contains Gass Peak, the southernmost extension of the northeast-trending Las Vegas Range and a portion of Las Vegas Valley to the south and west of Gass Peak. The WSAs in the study area are all in the alluvium.

Elevations range from 2,200 feet in the valley to 6,943 feet at Gass Peak. Highlands in the study area drain into Las Vegas Valley which empties into the Colorado River.

The dominant topographic feature in the study area is Gass Peak which is composed predominantly of Mississippian Bird Spring Formation. Gass Peak is bound on the south by the right lateral northwest trending Las Vegas Valley shear zone.

The WSAs in the GRA adjoin the Desert National Game Range on the north.

2. ROCK UNITS

The WSAs in the study area are entirely composed of alluvium and most of the following discussion concerns the bedrock exposures to the north and east of the WSAs.

The oldest rock unit is the Cambrian Wood Canyon Formation which consists of quartzites, sandstone, shale, siltstone and a few thin beds of dolomite. The Wood Canyon Formation is at the base of the upper plate of the Gass Peak thrust located along the north flank of Gass Peak.

The Cambrian Nopah Formation is the next youngest formation and crops out along the south face of Fossil Ridge. The Nopah Formation contains the Dunderburg shale as the lower member and a thick upper sequence of limestone and dolomite.

The Ordovician Pogonip limestone was deposited next and crops out on the north slope of Fossil Ridge. The Devonian Sultan limestone and Mississippian Monte Cristo limestone are the next youngest formations in the GRA and both crop out in the highly fractured cores of overturned anticlines southeast of Gass Peak.

The Bird Spring Formation was deposited throughout the Carboniferous and into the Permian and consists of a thick sequence of limestone and dolomite. Gass Peak is composed primarily of this formation.

The Horse Spring Formation, consisting largely of carbonate beds, was deposited unconformably on older beds during the Early Tertiary. This formation outcrops in the valley between Fossil Ridge and Gass Peak.

The Las Vegas Formation, consisting of firmly cemented early Quaternary gravels and fanglomerates, is found in the Tule Springs area in Las Vegas Valley. Younger alluvium in the form of alluvial fans are the latest units in the GRA, and underlie all the WSAs.

3. STRUCTURAL GEOLOGY AND TECTONICS

Structure in the bedrock exposures in the GRA consists of Late Cretaceous Laramide Orogeny related thrust faulting, and related folding, reverse faults, low- and high-angle normal faults, and right lateral displacement of the Las Vegas Valley shear zone.

The Gass Peak Thrust on the north flank of Gass Peak has an upper plate of Cambrian rocks overriding the Carboniferous Bird Springs Formation. It is estimated to have a stratigraphic throw of about 18,000 feet if minimum thicknesses are used to calculate displacement (Ebanks 1965). The trace of the fault plane is curvilinear with the southern portion trending northeast and the northern portion striking north-south. This is not an erosional feature as evidenced by the 25-50° dip of the fault plane changing from northwest to westward.

The eastward direction of the thrusting is established by numerous accordian folds in the beds of the footwall below the fault. These folds resulted from compression in the direction of overthrusting.

At Broken Hill southeast of Gass Peak, overturned east-west-trending anticlines whose axes plunge gently both east and west, have been highly fractured. These folds are parallel to the Gass Peak Thrust to the north and probably formed due to related compressional forces.

Southwest of East Pass on Gass Peak, compressive forces from north to northwest formed numerous reverse faults. Two of these faults parallel to the Gass Peak Thrust are quite long but their throw never exceeded a few tens of feet.

On the south slope of Gass Peak, two sets of east-west-trending normal faults cut the Bird Spring Formation. One set is downthrown to the south and the other is downthrown to the north.

Fossil Ridge is bound by northeast-trending normal high-angle faults which have the general orientation of Late Tertiary Basin and Range faults. It is postulated by Ebanks (1965) that these faults may also be related to drag movements from the right lateral displacement of the Las Vegas Valley Shear Zone.

The Las Vegas Shear Zone described by Longwell and others (1965) is a right lateral strike-slip fault with possibly 25 miles of movement. The fault trends northwest and traverses the Las Vegas Valley. Ebanks (1965) suggests that the Wheeler Pass thrust in the Spring Mountains, which displaces similar lithologies as the Gass Peak thrust, may be a continuation of the Gass Peak thrust. The 25 miles of right lateral displacement between these thrusts was possibly caused by movement along the Las Vegas Valley Shear Zone.

4. PALEONTOLOGY

Rocks of the Pennsylvanian-Permian Bird Spring Formation occur at the southern end of the Las Vegas Range in the northeast corner of the Nellis/Quail Spring GRA, and form the bulk of Gass Peak. Although fossils are probably present in these rocks, no precise localities were discovered in a search of the literature.

The Cambrian Zabriskie quartzite overlies the Wood Canyon Formation at the northern margin of the GRA along Fossil Ridge, and contains the vertical burrows of Scolithus (worm burrows) (Stewart, 1970). The Zabriskie is overlain by Cambrian strata containing the trilobite Bristolia, and underlain by an Early Cambrian Nevadella trilobite assemblage like that of the Poleta Formation. However, details of the lithology and sedimentary structures of the Zabriskie indicate a non-bioturbated, relatively high energy, highly oxygenated depositional environment not suited either to abundant vagile epifaunas such as trilobites or to the preservation of those invertebrates which might have been transported into the area. Presumably most dead shells would have been transported out of the Zabriskie depofacies and into the adjacent Harkless depofacies.

The southern extension of Fossil Ridge extends into the GRA, and both the Zabriskie and younger Carrara and Nevada(?) Formations (or equivalent Devonian rocks) are discontinuously fossiliferous. The Nevada(?) Formation contains abundant Brackiopod faunas, with abundant Atrypa species and other marine shallow water faunal elements.

Quaternary alluvium contains paleontological material derived from the older rocks, but no fossils unique to this youngest lithosome are recorded. Thus only reworked, weathered, and out of context paleontological material is found in the Quaternary alluvial deposits.

5. HISTORICAL GEOLOGY

During the Paleozoic age marine sediments were deposited uninterruptedly except for the periodic encroachment of the shoreline. As the shoreline approached, the arenaceous content of the rocks began to dominate over the calcareous. At the end of the Permian the area was uplifted and eroded.

During the Late Cretaceous overthrusting and folding related to the Laramide Orogeny occurred. A period of quiescence during the Early Tertiary is marked by the chemical precipitation of sediments of the Horse Creek Formation in intermontane shallow lakes.

Major strike-slip faulting on the Las Vegas Valley Shear Zone probably started about 14-15 million years ago, but actual documentation of their initiation time is lacking (Bohannon, 1980).

Basin and Range faulting subsequently offset the Horse Creek Formation, Gass Peak thrust sheet, and Paleozoic sediments during the late Tertiary.

Erosional processes formed the currently dissecting Early Quaternary fanglomerates and present alluvial fans upon which the WSAs are located.

III. ENERGY AND MINERAL RESOURCES

A. METALLIC MINERAL RESOURCES

1. Known Mineral Deposits

There is a small zinc mining district in the GRA but outside the WSA called the Gass Peak district southeast of Gass Peak. The district's only properties are the June Bug mine, the Sampson claim, and several prospects. The June Bug mine (see Metallics Land Classification and Occurrence Map) in Sec. 20, T 18 S, R 61 E, was the principal producer with a reported shipment of 1000 tons of ore in 1916-17 yielding zinc, lead, silver and gold. The mine is in dolomitized limestone that has been replaced by zinc oxide along shear zones (Longwell, 1965).

There are no known mineral deposits in any of the WSAs.

2. Known Prospects, Mineral Occurrences and Mineralized Areas

There are a few prospects associated with the above described Gass Peak district. There are no known prospects or occurrences in any of the WSAs.

3. Mining Claims

There are approximately 12 lode claims in the vicinity of the properties in the Gass Peak district. There are no known lode claims within the WSAs. There are several placer claims within WSA NV 050-0411 but their commodity or purpose is unknown, they are suspected of being for sand and gravel.

4. Mineral Deposit Types

The zinc mineralization in the Gass Peak district occurs in dolomitized limestone that has been replaced along shear zones by oxidized zinc mineralization. The mineralization is structurally controlled, high-temperature replacement deposits along narrow fissures.

5. Mineral Economics

Because of limited mineralization in the narrow veins and limited amount of past production at shallow depth, the area does not appear to be a prime target area for major mining companies. There is a possibility that a small operator could find and develop other high grade pockets of metal, however.

The major uses of zinc are in galvanizing, brass and bronze products, castings, rolled zinc and in pigments or other chemicals. About six million metric tons are produced annually, with the United States producing somewhat less than a quarter of a million tons. Domestic production has decreased dramatically over the past five years, largely as the result of closing down of most zinc smelters because of environmental problems. Imports into the United States are about one million tons per year, and zinc is listed as a strategic and critical metal. Both world-wide and domestic consumption are expected to increase at a moderate rate over the next twenty years. At the end of 1982 the price of zinc was about 38 cents per pound.

B. NONMETALLIC MINERAL RESOURCES

1. Known Mineral Deposits

The only known nonmetallic mineral deposit within the GRA is a report of limestone which was quarried prior to 1914 at the south end of the Las Vegas Range north of the WSAs. The limestone of Mississippian age was reported to be recrystallized during secondary dolomitization (Longwell, and others, 1965).

2. Known Prospects, Mineral Occurrences and Mineralized Areas

Limestone and dolomite is the dominant rock type in the bedrock outcrops in the GRA. Alluvial gravels cover the remainder of the GRA and all of the WSAs.

3. Mining Claims, Leases and Material Sites

There are no claims within the GRA which are known to have been staked for nonmetallic mineral resources.

There are seventeen placer claims, however, seven inside WSA NV 050-0411 (see Claim Map), which have been staked for an unknown commodity and possibly for sand and gravel. These claims are all located in the alluvial gravels and are part of a large block of several hundred claims which were staked in 1971 by Vega Inc. and for which the assessment work has been kept current.

There are no known material sites, sand and gravel sources, in any of the WSAs but there are abundant gravels which could be utilized by the nearby construction industry. There is at least one major concrete supplier in the Las Vegas area who has expressed an interest in this area as a potential future sand and gravel source (Bryan, 1982).

4. Mineral Deposit Types

The marble deposit is recrystallized (dolomitized) limestones which are part of an extensive marine carbonate sedimentary assemblage.

The alluvial fans which consist of sand and gravel are detrital deposits derived from the adjacent mountains.

5. Mineral Economics

Marble, if the quality is acceptible, could be quarried and marketed in the adjacent Las Vegas metropolitan area. Little building stone is used for construction nowadays, however, because of its high cost compared to other construction materials.

Sand and gravel throughout the GRA and the included WSAs could be a very marketable commodity, if the quality was acceptable. The nearness to the Las Vegas market is its principal advantage. At least one major construction company has expressed interest in the sand and gravel potential in this area.

The most common use of sand and gravel is as "aggregate" -- as part of a mixture with cement to form concrete. The second largest use is as road base, or fill. About 97 percent of all sand and gravel used in the United States is in these applications in the construction industry. The remaining three percent is used for glassmaking, foundry sands, abrasives, filters and similar applications. The United States uses nearly one billion tons of sand and gravel annually, all of it produced domestically except for a very small tonnage of sand that is imported for highly specialized uses. Since construction is by far the greatest user of sand and gravel, the largest production is near sites of intensive construction, usually metropolitan areas. Since sand and gravel are extremely common nearly everywhere, the price is generally very low and mines are very close to the point of consumption -- within a few miles as a rule. However, for some applications such as high-quality concrete there are quite high specifications for sand and gravel, and acceptable material must be hauled twenty miles and more. Demand for sand and gravel fluctuates with activity in the construction industry, and is relatively low during the recession of the early 1980s. Demand is expected to increase by about one third by the year 2000. In the early 1980s the price of sand and gravel F.O.B. plant averaged about $2.50 per ton but varied widely depending upon quality and to some extent upon location.

C. ENERGY RESOURCES

Uranium and Thorium Resources

1. Known Mineral Deposits

There are no known deposits of thorium or uranium in or near the GRA or WSAs.

2. Known Prospects, Mineral Occurrences and Mineralized Areas

There are no known uranium or thorium prospects or occurrences in the WSAs. However there is one radioactive occurrence in the GRA which is shown on the Uranium Land Classification and Mineral Occurrence Map included in the back of the report. Anomalous radioactivity is associated with malachite, chrysocolla and iron oxides in brecciated dolomite of the Monte Cristo Limestone at the Sampson and Sampson No. 1 claim in the SE 1/4 NE 1/4 Sec. 24, T 18 S, R 61 E (Garside, 1973). No thorium or uranium minerals were identified at the prospect.

3. Mining Claims

The only known uranium claims in the area are the Sampson and Sampson No. 1 claims, and these have probably lapsed. There are no known thorium claims or leases in the GRA.

4. Mineral Deposit Types

There are no known deposits of uranium or thorium in the area.

5. Mineral Economics

Uranium and thorium appear to be of little or no economic value in the area. Only one small radioactive occurrence is known in the area, as noted above.

Uranium in its enriched form is used primarily as fuel for nuclear reactors, with lesser amounts being used in the manufacture of atomic weapons and materials which are used for medical radiation treatments. Annual western world production of uranium concentrates totaled approximately 57,000 tons in 1981, and the United States was responsible for about 30 percent of this total, making the United States the largest single producer of uranium (American Bureau of Metal Statistics, 1982). The United States ranks second behind Australia in uranium resources based on a production cost of $25/pound or less. United States uranium demand is growing at a much slower rate than was forecast in the late 1970s, because the number of new reactors scheduled for construction has declined sharply since the accident at the Three Mile Island Nuclear Plant in March, 1979. Current and future supplies were seen to exceed future demand by a significant margin and spot prices of uranium fell from $40/pound to $25/pound from January, 1980 to January, 1981 (Mining Journal, July 24, 1981). At present the outlook for the United States uranium industry is bleak. Low prices and overproduction in the industry have resulted in the closures of numerous uranium mines and mills and reduced production at properties which have remained in operation. The price of uranium at the end of 1982 was $19.75/pound of concentrate.

Oil and Gas Resources

1. Known Oil and Gas Deposits

   There are no known oil and gas deposits in the GRA.

2. Known Prospects, Oil and Gas Occurrences, and Petroliferous Areas

   There are no oil seeps in the GRA or bordering valleys. Although no exploration wells have been drilled in the GRA, three have been completed six miles outside of the GRA to the east and south as shown on the Oil and Gas Land Classification Occurrence Map, (Lintz, 1957; Schilling and Garside, 1968):

   Southern Nevada Oil Investors, Apex No. 1 (Locality #1)
   1,455' TD, 1950

   United Petroleum, Apex No. 1 (also #1)
   1,247' TD, 1948

   C. J. Lichtenwalter and C. M. Turpin, Turpin No. 1 (#2)
   777' TD, 1961

   Further south there are fourteen wells that have been drilled in nine localities (#3-#11) by Independents between 1923 and 1971. These wells were drilled from 522 to 8,508 feet in depth. Oil shows were recorded in at least three of the wells (#8 and #10).

3. Oil and Gas Leases

Federal oil and gas leases cover all four WSAs in their entirety.

4. Oil and Gas Deposit Types

The GRA is within or close to the North American Overthrust Belt which has good oil and gas production in Wyoming/Utah, Mexico and Canada (Oil and Gas Jour., May 12, 1980). The Federal leases in Nevada are for rank wildcat acreage, and surficial stratigraphic units do not necessarily have a direct bearing on possible drilling objectives at depth, considering overthrust structural implications.

Recent seismic surveys (e.g., Seisdata Services, 1981; Geophysical Service Inc., 1981; GeoData, 1981: Index maps in GRA File) indicate, in part, the general area of industry interest. This and certain other data may be purchased, but deep exploratory test data are not readily available. Published maps of the Overthrust Belt in Nevada are very generlaized, and are not necessarily in agreement because exploration is at an early stage (Oil and Gas Jour., May 12, 1980; Western Oil Reporter, June, 1980; Keith, 1979: Index maps in GRA File).

5. Oil and Gas Economics

The low level of production from Nevada Basin and Range oil fields, which are remote from existing pipelines, existing refineries and consuming areas, necessitates the trucking of the crude oil to existing refineries in Utah, California and Nevada. Since the discovery of oil in Nevada in 1953, the level of production has fluctuated. Factors which have affected the production from individual wells are: reservoir and oil characteristics; Federal regulations; productivity; environmental constraints; willingness or ability of a refiner to take certain types of oil; and of course, the price to the producer, which is tied to regional, national and international prices.

Geothermal Resources

1. Known Geothermal Deposits

There are no geothermal deposits in the GRA.

2. Known Prospects, Geothermal Occurrences, and Geothermal Areas

There are no known prospects, occurrences or thermal areas in the GRA or vicinity. There has been extensive drilling for water in the north Las Vegas metropolitan area that produced water of up to 85°F, but none in or close to the GRA.

3. Geothermal Leases

There are no Federal geothermal leases in the GRA or the Las Vegas Valley area.

4. Geothermal Deposit Types

Geothermal resources are hot water and/or steam which occurs in subsurface reservoirs or at the surface as springs. The temperature of a resource may be about 70°F (or just above average ambient air temperature) to well above 400°F in the Basin and Range province.

The reservoirs may be individual faults, intricate fault-fracture systems, or rock units having intergranular permeability -- or a combination of these. Deep-seated normal faults are believed to be the main conduits for the thermal waters rising from thousands of feet below in the earth's crust.

The higher temperature and larger capacity resources in the Basin and Range are generally hydrothermal convective systems. The lower temperature reservoirs may be individual faults bearing thermal water or lower pressured, permeable rock units fed by faults or fault systems. Reservoirs are present from the surface to over 10,000 feet in depth.

5. Geothermal Economics

Geothermal resources are utilized in the form of hot water or steam normally captured by means of drilling wells to a depth of a few feet to over 10,000 feet in depth. The fluid temperature, sustained flow rate and water chemistry characteristics of a geothermal reservoir determine the depth to which it will be economically feasible to drill and develop each site.

Higher temperature resources (above 350°F) are currently being used to generate electrical power in Utah and California, and in a number of foreign countries. As fuel costs rise and technology improves, the lower temperature limit for power will decrease appreciably -- especially for remote sites.

All thermal waters can be beneficially used in some way, including fish farming (68°F), warm water for year round mining in cold climates (86°F), residential space heating (122°F), greenhouses by space heating (176°F), drying of vegetables (212°F), extraction of salts by evaporation and crystallization (266°F), and drying of diatomaceous earth (338°F).

Unlike most mineral commodities remoteness of resource location is not a drawback. Domestic and commercial use of natural thermal springs and shallow wells in the Basin and Range province is a historical fact for over 100 years.

Development and maintenance of a resource for beneficial use may mean no dollars or hundreds of millions of dollars, depending on the resource characteristics, the end use and the intensity or level of use.

D. OTHER GEOLOGICAL RESOURCES

There are no unusual or unique geological resources known to exist in the GRA or the WSAs.

E. STRATEGIC AND CRITICAL MINERALS AND METALS

A list of strategic and critical minerals and metals provided by the BLM was used as a guideline for the discussion of strategic and critical materials in this report.

The Stockpile Report to the Congress, October 1981-March 1982, states that the term "strategic and critical materials" refers to materials that would be needed to supply the industrial, military and essential civilian needs of the United States during a national emergency and are not found or produced in the United States in sufficient quantities to meet such need. The report does not define a distinction between strategic and critical minerals.

Zinc was produced on a limited scale from the June Bug mine in the Gass Peak district in the northern portion of the GRA. Silver was a by-product of this mining activity. These minerals were produced from properties outside the WSAs.

IV. LAND CLASSIFICATION FOR G-E-M RESOURCES POTENTIAL

Geologic maps covering this GRA include Longwell's (1965) county geologic map and Howard (1978) both at a scale of 1:250,000 and both essentially the same. Since the WSAs are completely composed of alluvium a more detailed map would not assist in assessing metallic mineral potential in the WSAs but would help in the bedrock exposures to the north and east. Overall, the quantity of geologic data available could be better for the bedrock areas adjacent to the WSAs but the quality of the available data is high. The quantity of data concerning the mineralization is also limited but here again for what is available the quality is high. The overall level of confidence in the available data is high.

Land classification areas are numbered starting with the number 1 in each category of resources. Metallic mineral land classification areas have the prefix M, e.g., M1-4D. Uranium and thorium areas have the prefix U. Nonmetallic mineral areas have the prefix N. Oil and gas areas have the prefix OG. Geothermal areas have the prefix G. Sodium and potassium areas have the prefix S. The saleable resources are classified under the nonmetallic mineral resource section. Both the Classification Scheme, numbers 1 through 4, and the Level of confidence Scheme, letters A, B, C and D, as supplied by the BLM are included as attachments to this report. These schemes were used as strict guidelines in developing the mineral classification areas used in this report.

Land classifications have been made here only for the areas that encompass segments of the WSA. Where data outside a WSA has been used in establishing a classification area within a WSA, then at least a part of the surrounding area may also be included for clarification. The classified areas are shown on the 1:250,000 mylars or the prints of those that accompany each copy of this report.

In connection with nonmetallic mineral classification, it should be noted that in all instances areas mapped as alluvium are classified as having moderate favorability for sand and gravel. All areas mapped as principally limestone or dolomite have a similar classification since these rocks are usable for cement or lime production. All areas mapped as other rock, if they do not have specific reason for a different classification, are classified as having low favorability, with low confidence, for nonmetallic mineral potential, since any mineral material can at least be used in construction applications.

1. LOCATABLE RESOURCES

a. Metallic Minerals

WSA NV 050-0411 and WSA NV 050-04R-15A, B, & C

M1-2A. This classification area of low favorability with a very low confidence level includes all the area covered by the four WSAs within the GRA. This includes the alluvial fans composed of sand and gravel derived from the mountains to the north of the WSAs. The classification is designated 2A because the nature of the bedrock beneath the alluvium is unknown, the adjacent Paleozoic rocks do show some mineralization (Gass Peak district), many other areas of Southern Nevada have mineralization in the Paleozoic section. The possibility does exist, therefore, that the bedrock beneath the alluvium is mineralized.

b. Uranium and Thorium

WSA NV 050-0411, WSA NV 050-04R-15A, B, & C

U1-1A. This land classification area covers the northwest, southwest and southern portions of the GRA and includes WSA NV 050-0422, and WSA NV 050-04R-15A, B, and C. The area is covered by Quaternary alluvium and lake deposits, and is not favorable for uranium or thorium at a very low confidence level due to the lack of known source rocks for these elements in the vicinity.

U2-2B. This land classification area covers the north-central and northeast sections of the GRA. The area has low favorability for uranium mineralization at a low level of confidence in fractures or breccia zones in the Paleozoic carbonates which cover the area. One radioactive occurrence has been reported in a breccia zone in the Monte Cristo limestone in Sec. 24, T 18 S, R 61 E. This occurrence is probably related to the deposition of copper minerals in the zone.

The area has no favorability for thorium deposits, at a very low confidence level, due to the lack of known igneous source rocks (pegmatites or granites).

c. Nonmetallic Minerals

WSA NV 050-0411 and WSA NV 050 04R-15A, B & C

N1-3C. This classification area is one of moderate favorability with a moderate confidence level and includes all the areas covered by the four WSAs within the GRA. All this area is composed of sand and gravel in the form of alluvial fans derived from the mountains to the north.

The gravels are most likely composed predominantly of carbonate rocks, reflecting the composition of the bedrock outcrops which have eroded to form the fans. Elsewhere in the Las Vegas Valley similar carbonate gravels make good aggregates for use in many aspects of the construction industry, including for use in concrete. A higher classification than 3C is not used here because the individual site-specific material would have to be further evaluated to adequately assess its suitability for specific construction purposes. At least one major aggregate supplier in Las Vegas has indicated an interest in this area for future aggregate supplies (Bryan, 1982).

2. LEASABLE RESOURCES

a. Oil and Gas

WSAs NV 050-0411, NV 050-04R-15A, B & C

OG1-2A. The WSAs are underlain by Quaternary alluvium which covers Paleozoic and possibly an appreciable thickness of younger strata. The United Petroleum Apex No. 1 (#1) recorded a gas show at 920 feet in a brecciated limestone and the Lichtenwalter-Turpin Turpin No. 1 (#2) had oil shows in the interval 307-777 feet. The Permian was perforated at 178.5-179.5 and 262-272 feet, acidized and made one-third barrel of high gravity oil (Nevada Bureau of Mines and Geology Oil and Gas Files, 1982). This well bottomed in the Permian (Schilling and Garside, 1968).

The exploratory wells to the south (#3-#11) were all Paleozoic tests. The McCauley No. 1 (#3), Wilson Government No. 1 (#4), J. B. Nelson No. 1 (#9) and Wilson No. 1 each had shows of hydrocabrons in the Middle to Upper Paleozoic section (Nevada Bureau of Mines and Geology Oil and Gas Files, 1982).

This group of WSAs is believed to be within the Overthrust Belt where it passes through Nevada, which adds an additional drilling objective to the normal Paleozoic section.

b. Geothermal

WSAs NV 050-0411, NV 050-04R-15A, B & C

G1-2A. The WSAs are at the far northern edge of Las Vegas Valley where low-tempature geothermal resources have been encountered in wells. Thermal waters in wells, adjusted for a geothermal gradient of 1°F/75 feet, are 70° to 85°F in the northern half of the valley (Garside and Schilling, 1979).

The geologic environment is generally similar throughout the northern portion of the Valley including the area of the WSAs.

c. Sodium and Potassium

S1-1D. There are no sodium or potassium resources known or suspected to exist in the WSAs.

3. SALEABLE RESOURCES

Saleable resources, sand and gravel, have been discussed above under nonmetallic resources and includes the classification area N1-3C.

V. RECOMMENDATIONS FOR ADDITIONAL WORK

The placer claims staked in WSA NV 050-0411 should be checked to try to determine the mineral commodity they were located for. Vega Inc., the owners of the claims, should be contacted to help determine for what commodity the claims were staked. The WSAs are in a prime location for development of sand and gravel and should be evaluated for their potential for that commodity.

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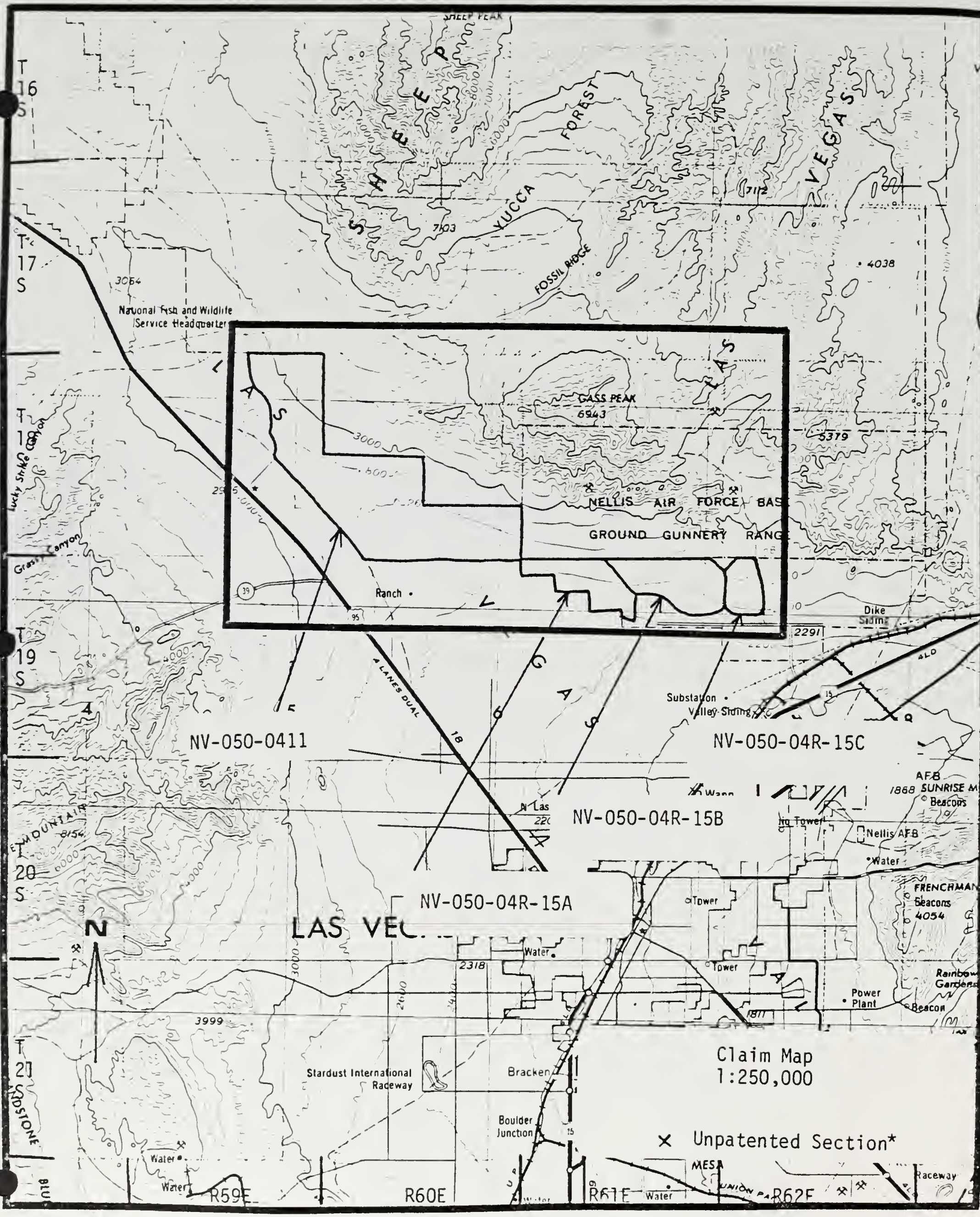
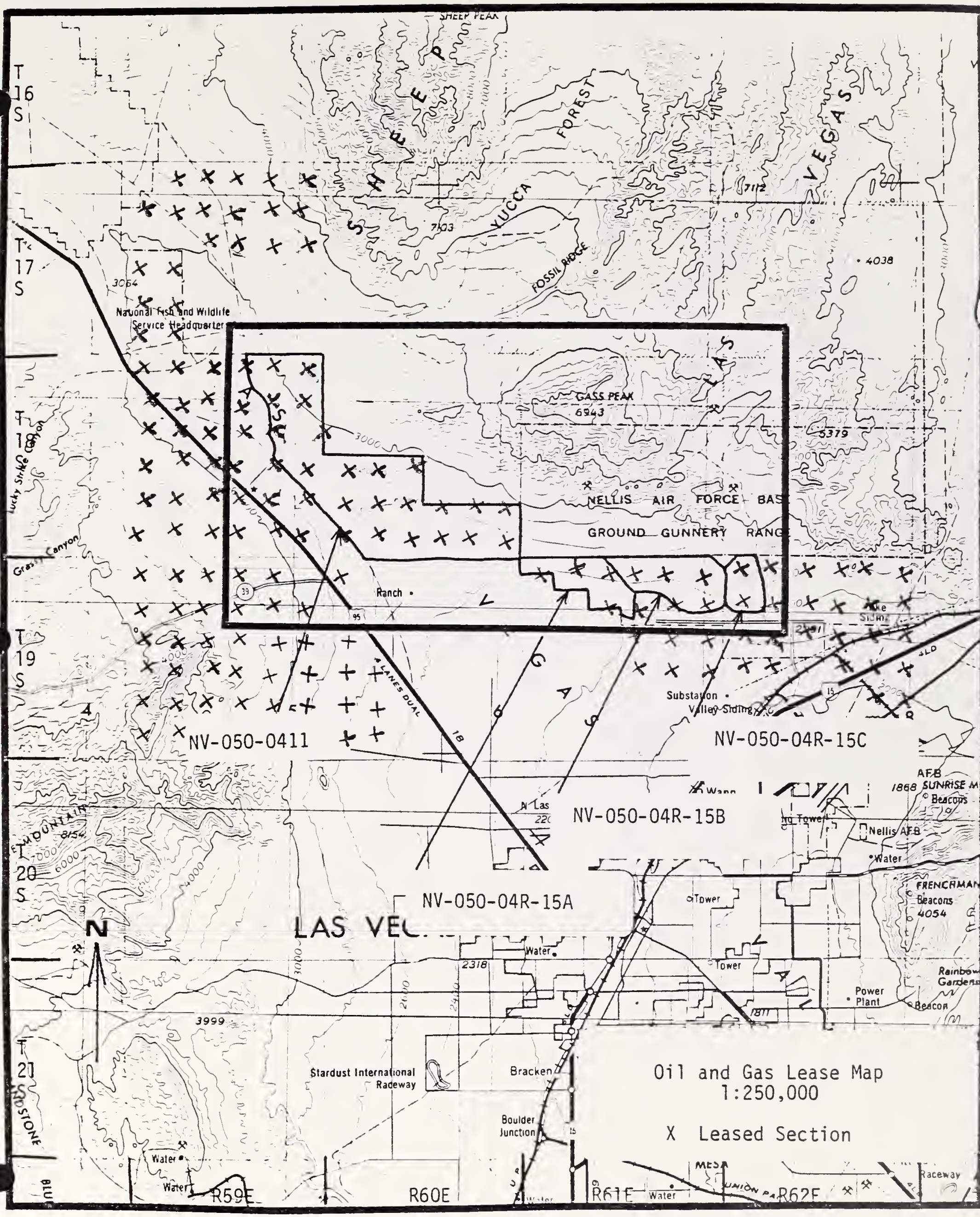
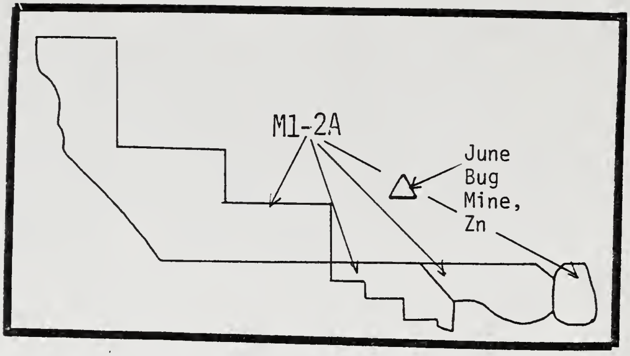


*X denote one or more claims per section

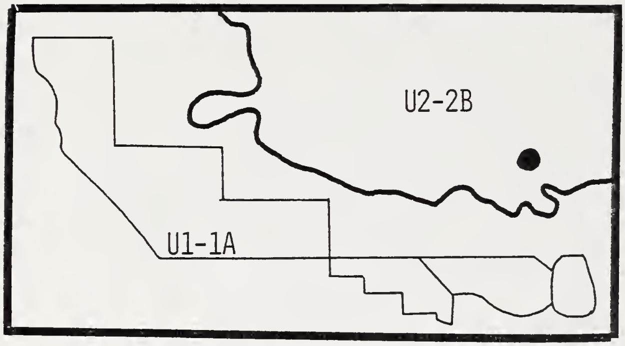
Nellis/Quail Spring GRA NV-33


NV-050-0411
NV-050-04R-15C
NV-050-04R-15B
NV-050-04R-15A
Oil and Gas Lease Map
1:250,000
X Leased Section
GASS PEAK
NELLIS AIR FORCE BAS
GROUND GUNNERY RANG
National Fish and Wildlife Service Headquarters
LAS VEGAS
Stardust International Raceway
Bracken
Boulder Junction
Nellis AFB
R59E
R60E
R61E
R62E



Land Classification - Mineral Occurrence Map/Metallics

Nellis/Quail Spring GRA NV-33
Scale 1:250,000



EXPLANATION

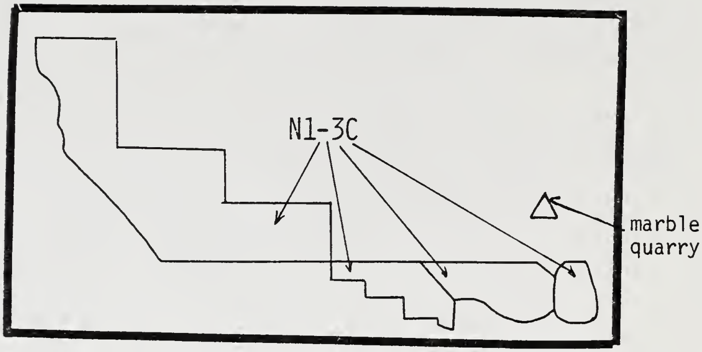
● Uranium Occurrence

— Land Classification Boundary

— WSA Boundary

Land Classification - Mineral Occurrence Map/Uranium

Nellis/Quail Spring GRA NV-33
Scale 1:250,000



EXPLANATION

△ Mine, commodity

— Land Classification Boundary

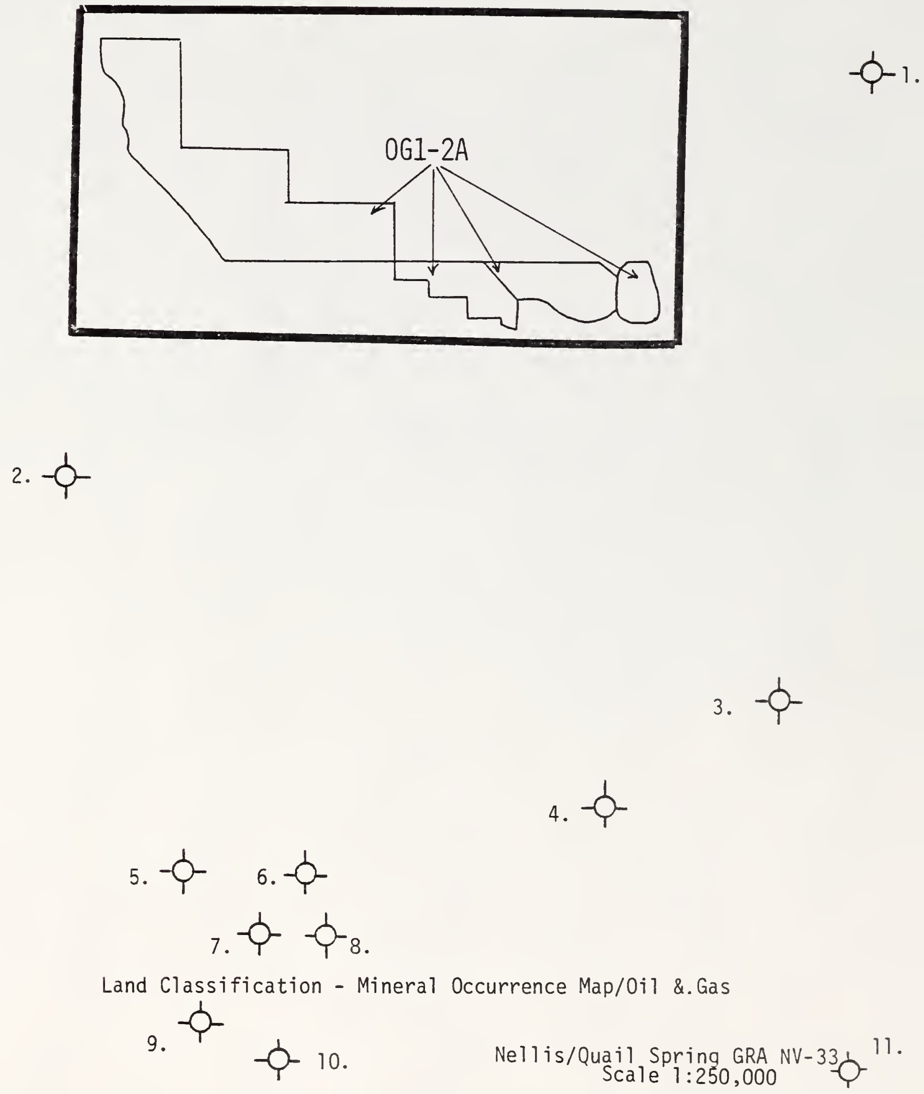
— WSA Boundary

EXPLANATION

1. Reference location (see text)

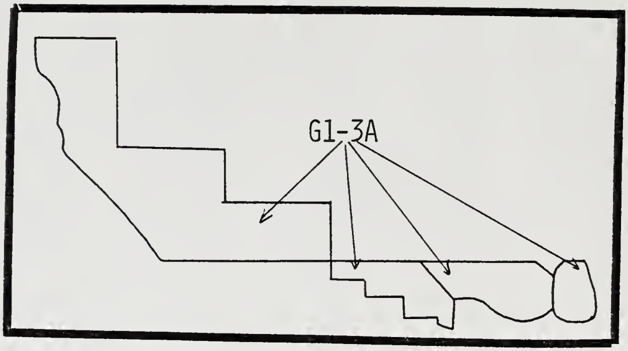
WSA and Land Classification Boundary

Dry Hole



Land Classification - Mineral Occurrence Map/Oil &.Gas

Nellis/Quail Spring GRA NV-33
Scale 1:250,000



EXPLANATION

○ Thermal Well

Thermal Spring

— WSA and Land Classification Boundary

LEVEL OF CONFIDENCE SCHEME

A. THE AVAILABLE DATA ARE EITHER INSUFFICIENT AND/OR CANNOT BE CONSIDERED AS DIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES WITHIN THE RESPECTIVE AREA.

B. THE AVAILABLE DATA PROVIDE INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

C. THE AVAILABLE DATA PROVIDE DIRECT EVIDENCE, BUT ARE QUANTITATIVELY MINIMAL TO SUPPORT TO REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

D. THE AVAILABLE DATA PROVIDE ABUNDANT DIRECT AND INDIRECT EVIDENCE TO SUPPORT OR REFUTE THE POSSIBLE EXISTENCE OF MINERAL RESOURCES.

CLASSIFICATION SCHEME

1. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES DO NOT INDICATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

2. THE GEOLOGIC ENVIRONMENT AND THE INFERRED GEOLOGIC PROCESSES INDICATE LOW FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

3. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, AND THE REPORTED MINERAL OCCURRENCES INDICATE MODERATE FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

4. THE GEOLOGIC ENVIRONMENT, THE INFERRED GEOLOGIC PROCESSES, THE REPORTED MINERAL OCCURRENCES, AND THE KNOWN MINES OR DEPOSITS INDICATE HIGH FAVORABILITY FOR ACCUMULATION OF MINERAL RESOURCES.

MAJOR STRATIGRAPHIC AND TIME DIVISIONS IN USE BY THE U.S. GEOLOGICAL SURVEY

Erathem or Era	System or Period	Series or Epoch	Estimated ages of time boundaries in millions of years
Cenozoic	Quaternary	Holocene	
		Pleistocene	2-3 [1]
	Tertiary	Pliocene	12 [1]
		Miocene	26 [2]
		Oligocene	37-38
		Eocene	53-54
		Paleocene	65
Mesozoic	Cretaceous [4]	Upper (Late) Lower (Early)	136
	Jurassic	Upper (Late) Middle (Middle) Lower (Early)	190-195
	Triassic	Upper (Late) Middle (Middle) Lower (Early)	225
Paleozoic	Permian [4]	Upper (Late) Lower (Early)	280
	Carboniferous Systems: Pennsylvanian [4]	Upper (Late) Middle (Middle) Lower (Early)	
	Carboniferous Systems: Mississippian [4]	Upper (Late) Lower (Early)	345
	Devonian	Upper (Late) Middle (Middle) Lower (Early)	395
	Silurian [4]	Upper (Late) Middle (Middle) Lower (Early)	430-440
	Ordovician [4]	Upper (Late) Middle (Middle) Lower (Early)	500
	Cambrian [4]	Upper (Late) Middle (Middle) Lower (Early)	570
Precambrian [3]		Informal subdivisions such as upper, middle, and lower, or upper and lower, or younger and older may be used locally.	3,600 + [3]

[1] Holmes, Arthur, 1965, Principles of physical geology: 2d ed., New York, Ronald Press, p. 360-361, for the Pleistocene and Pliocene; and Obradovich, J. D., 1965, Age of marine Pleistocene of California: Am. Assoc. Petroleum Geologists, v. 49, no. 7, p. 1087, for the Pleistocene of southern California.

[2] Geological Society of London, 1964, The Phanerozoic time-scale; a symposium: Geol. Soc. London, Quart. Jour., v. 120, supp., p. 260-262, for the Miocene through the Cambrian.

[3] Stern, T. W., written commun., 1968, for the Precambrian.

[4] Includes provincial series accepted for use in U.S. Geological Survey reports.

Terms designating time are in parentheses. Informal time terms early, middle, and late may be used for the eras, and for periods where there is no formal subdivision into Early, Middle, and Late, and for epochs. Informal rock terms lower, middle, and upper may be used where there is no formal subdivision of a system or of a series.

GEOLOGIC NAMES COMMITTEE, 1970